Between Walls and Water:
Technocratic planning of stormwater infrastructure and the reshaping of everyday life in flood-prone Mumbai

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Abstract
Mumbai has been experiencing an increasing frequency of extreme climate events that result in recurrent monsoon flooding. Challenging the prevailing view of flooding as an infrastructural crisis, this paper argues that flooding is instead an inevitable consequence of systemic failures in the city's technocratic planning regime. It critically examines the BRIMSTOWAD masterplan in developing the city's stormwater infrastructure. It attempts to understand how the absence of such infrastructure exacerbates existing spatial vulnerabilities, reshaping the everyday life of marginalised communities living in flood prone areas. Through a case study of the 2019 Malad wall collapse, the paper analyses how stormwater drainage, housing crisis, and regulatory planning practices intersect during a flood event, demonstrating that Mumbai's flooding crisis is deeply tied to its urban development model.

Keywords: stormwater infrastructure, technocratic planning, urban flooding

Introduction

The metropolitan city of Mumbai has been grappling with an increasing frequency of extreme rainfall events attributed to climate change and the subsequent flooding that follows them. Historian Miriam Dossal, narrating her observation of the city in 1990, wrote that 'water and drainage continue to be the bane of Bombay[1] and every monsoon the problems are aggravated' (Dossal, 1996). Today, even after two decades, her observations remain just as valid for Mumbai. In the period from 2000-2024, Mumbai has recorded 18 extreme rainfall events (greater than 204.5mm rainfall/day) and 11 very heavy rainfall events (115.6-204.4mm rainfall/day)(*IMD*). Based on IMD (Indian Meteorological Department) data (1985–2024), Mumbai's rainfall has become highly skewed and unevenly distributed, meaning a small number of extreme rainfall days contribute disproportionately to the total monsoon rainfall[2]. Every monsoon, heavy rains almost always wreak havoc in everyday life leaving several neighbourhoods inundated and residents struggling to adapt to the high waters. What should ideally be rare practices of coping have become an annual ritual making Mumbaikars habituated to regular flooding (Jamwal, 2017). Meanwhile, actions of the State have aimed at strategically deregulating environmental laws and policies meant to protect the city's riparian and coastal zones—which are vital socio-ecological systems actively sustaining livelihoods and mitigating flood impacts—for intensively constructing infrastructure and real estate projects aimed at the city's economic development (Indorewala, 2018; Menon et al., 2015; Nijman, 2002; Wagh, 2018; Wagh & Indorewala, 2025; Zope et al., 2015). Scholars and activists analysing the narratives of disaster and resilience of Mumbaikars expound that any city that regularly demands such a price for survival and such a toll on human life, is not unprepared for calamity – it is unprepared for normality (Indorewala & Wagh, 2018).

The response by the state's planning system to "fix" the problem of flooding has been highly technocratic—envisioned and implemented primarily through the augmentation of the city's stormwater drainage through mega infrastructural projects such as the BRIMSTOWAD (Brihan Mumbai Stormwater Drainage) masterplan (Gupta, 2007). Despite the massive investment of public funds into the building of stormwater infrastructure, 'technological-fixes' like the BRIMSTOWAD have been grossly ineffective in keeping majority of the city's areas from being water-logged and inundated during the monsoon, leaving its inhabitants with the perpetual daunting question: *why does Mumbai flood year after year?* Through this paper, I attempt to expound upon this seemingly simple yet fundamentally complex question of urban flooding by examining it through the lens of urban planning. Arguing against the mainstream notion that attributes flooding as an infrastructural crisis persisting due to "lack of planning", "corruption" or "non-implementation of infrastructure projects", I contend that flooding is a recurring symptom of the near-perfect implementation of a technocratic planning system—which produces infrastructural projects such as the BRIMSTOWAD—discriminately aimed at maximising the economic potential

1 The city's original name was changed from 'Bombay' to 'Mumbai' in 1995. The article will address the city as 'Bombay' while referring to contexts before the mid 90s, and 'Mumbai' while discussing contexts post the mid 90s.
2 Fewer than 5% of rainy days (approximately 4–6 days/year) deliver more than 50% of Mumbai's monsoon rainfall, with extreme events clustering in July and August. A single event accounts for 30-50% of the monthly rainfall in which occurred.

of Mumbai's land at the cost of systematically undermining the *socio-ecological* relationship between land and water. The paper explores the question of urban drainage within this paradigm by critically examining the role of technocratic planning in the development of stormwater infrastructure and its impacts on everyday life. It intends to understand how the 'constructed' presence or the 'planned' absence of formal stormwater infrastructure exacerbates existing spatial vulnerabilities specifically targeting marginalised classes and communities living in flood prone areas, and alters conditions of everyday life in the city particularly during flood events. In doing so, I seek to unravel the intersections between flooding and other connected urban crises pertaining to the city's built environment by studying how their relations shape the planning of the city's stormwater drainage and in turn get shaped by its outcomes.

The paper's theoretical framework delves into the critiques of technocratic planning in the development of public infrastructure for spatial water, layered by an engagement with perspectives of political ecology concerned with power relations underlying the practices that make and unmake such infrastructures. Furthermore, it synthesises insights from the socio-technical construction of infrastructural 'fixes' in planning literature and the socio-ecological construction of flooding within political ecology perspectives for building an analytical approach to unravel the material practices that shape everyday life. Discursively engaging with the notion of everyday life as the level where impacts of floods are observed, the paper explores how material practices, of both planning and the everyday, can serve as a lens to trace the linkages between stormwater drainage and the consequences of inter-related crises unfolding during flood events.

Guided by the theoretical framework outlined above, I address the research questions mentioned above by adopting a two-part methodological approach. The approach focuses on observing everyday practices of vulnerable inhabitants alongside state planning practices, revealing the complexities of stormwater drainage in Mumbai from its historical roots to its spatially uneven consequences. The first part (see section 3) critically examines Mumbai's BRIMSTOWAD (Brihan Mumbai Stormwater Disposal) project through a qualitative policy analysis, assessing its planning, implementation, challenges, and outcomes. In the second part (see section 4), I take the case of the 2019 Malad wall collapse, a disaster triggered by extreme rainfall that caused a periphery wall to collapse onto an adjacent settlement, resulting in significant loss of life and property. Taking this case, I empirically investigate the interplay between flooding and inter-connected compounding urban crises. Through this case study, the paper traces material practices of planning and everyday life to analyse living conditions before, during, and after the disaster. Using qualitative spatial analysis, the paper draws systemic linkages between flooding and other urban crises related as housing and environmental (de)regulation. The analysis is followed by a synthesis of its findings to understand how flood events do not merely expose but actively intensify these underlying compounding crises. In conclusion of the paper, I highlight the need to critically examine everyday life in cities to better frame the problem of flooding, and the urgency for reimagine stormwater drainage by prioritising the needs of marginalised communities in the city.

Theoretical framework

The planning of water in relation to the urbanisation of land has typically followed a modernist-technocratic infrastructural approach based on manipulating, modifying, containing and controlling water's accumulation and flow (Anand, 2017; Björkman, 2015; Kaika, 2005; Mathur & Cunha, 2009). Studying the historical flows of water in the various visions of city planning over the last century, Maria Kaika observes that as water became controlled, tamed, and domesticated, its presence and availability became "normalised" and taken for granted (Kaika, 2005). This is reflected in infrastructure planning dealing with water where practices have remained largely as rational, centralised, expert-driven systems up until the present, despite the planning regime becoming more socially oriented over the second half of the 20th century (Furlong et al., 2016). Critiques of technocratic approaches to stormwater planning have fundamentally challenged how urban planning as a discipline conceptualises and manages the relationship between water and land (Baviskar, 2017; Ranganathan, 2015). Over the second half of the last century, new directions in planning theory such as advocacy planning (Davidoff, 1965), communicative planning (Forester, 1980), and justice planning (Fainstein, 2010; Harvey, 2009; Marcuse et al., 2009) have sought to expose power relations latent within technocratic and rational planning practices, thereby challenging the institutional logics that prioritise certain interests over others. They have questioned and scrutinised the values, logic, ideals and power relations that underscore institutional processes and practices of technocratic planning, by asking—in whose interest are these practices undertaken, at what and whose cost, and aimed at what kind of environmental transformation? When combined with political ecology perspectives this critique from the

planning domain gains sharper focus, revealing how everyday injustices, from flood vulnerability to housing precarity, are not accidental outcomes but systemic consequences of planning paradigms (Henrique, 2023; Rusca & Cleaver, 2022).

Political ecology is concerned with the analysis of power in constituting of social and environmental conditions and how unequal power relations are often linked to conflicts over access to, and the use of, diverse environmental resources (Bryant, 1998). Comprehensive research on the political ecology of water has produced different knowledge perspectives—hydro-social territories (Boelens et al., 2016), social-hydrology (Liao & Schmidt, 2023; Linton & Budds, 2014), and waterscapes (Goh, 2019; Swyngedouw, 1999), to name a few—that look at water as a hybrid construct, emphasising its relational character with society, where technical representations of its economic, biophysical and engineering dimensions intersect with questions concerning social power and political economy (Karpouzoglou & Vij, 2017; Swyngedouw, 1999; Swyngedouw et al., 2002). These perspectives argue against the reductive logic—implicit in the technocratic usage of planning instruments such as land-use, zoning and built form regulations—that treats water as an external element to be contained and controlled through engineered solutions rather than as an intrinsic component of urban socio-ecological systems (Gandy, 2014; Swyngedouw, 1999; Swyngedouw et al., 2002; Wagh & Indorewala, 2025). They provide useful insights for understanding the ways in which water related problems may be socio-politically constructed and linked to other urban crisis, and how this process of social construction may facilitate the control of people and environments by powerful actors (Bryant, 1998). These perspectives enable us to interrogate why the state consistently frames flooding as an extrinsic problem stemming from natural forces, rather than acknowledging it as an intrinsic outcome of its own planning paradigms and interventions. To question the identification and framing of flooding as a problem and its intersections with other urban crises means considering the threatened livelihoods linked to altered social and environmental conditions that figure centrally in political ecology thinking (Bryant and Bailey, 1997). Feminist political ecologists further illustrates how situated material responses to everyday flood threats as well as organised practical resistance tactics emerge from everyday spaces (Henrique, 2023). Peter Marcuse's assertion that 'the city is the scale where questions of justice are felt concretely as part of everyday life' (Marcuse et al., 2009) underscores the need to examine how material practices shape lived experiences, especially during periods when multiple urban crises unfold simultaneously. In this paper, I employ 'material practices' as an analytical lens to integrate the aforementioned theoretical perspectives, enabling observation of how urban crises unfold simultaneously and how stormwater infrastructure impacts everyday life in Mumbai during flood events.

The BRIMSTOWAD masterplan and the transformation of stormwater infrastructure in Mumbai

The landscape of Mumbai has undergone extensive environmental transformation since the time it was acquired as 'Bombay island' (see Figure 1) in dowry by the English king Charles II, on his marriage to the Portuguese princess Catherine of Braganza in 1661 and subsequently leased to the East India Company (Dossal, 1996). In its growth as a metropolitan region, now spread across 4355 sq.km (see Figure 2), dealing with spatial water in all its hostile and distinct "natures"—which included coastal landscapes, tidal marshes, riparian areas, mangrove forests, and swamplands—was an inevitable task encountered in processes of reclaiming and expanding the colonial city (Indorewala & Wagh, 2022; Meera Kosambi, 1986). Most of the reclaimed lands in the city lie below the High Tide Line[3] whose outfall of stormwater is not naturally leading to the sea on the eastern and western shores (BMC, 2018; Dossal, 1996). Mastering stormwater drainage, therefore, has always been a prerequisite for making its urban landscape inhabitable, sanitary and healthy (Dossal, 1996; Indorewala et al., 2016).

3 The Town Hall Datum (THD), established at the historic Bombay Town Hall (now Asiatic Society) in Mumbai's Fort area, serves as the city's official vertical reference point for elevation measurements and is set at +3.658 meters above Mean Sea Level (MSL). The High Tide Line (HTL) is the highest elevation reached by seawater during spring tides In Mumbai (BMC, 2018).

Figure 1: The Bombay Group of Islands (Indorewala et al., 2016)

Figure 2: Map of Mumbai Metropolitan Region (MMR) (Indorewala et al., 2016)

Post the catastrophic 2005 mega flood, Mumbai's stormwater infrastructure has undergone significant transformation and expansion, radically reshaping the city's drainage patterns through engineered solutions for controlled water disposal. This comprehensive infrastructure is governed by the BRIMSTOWAD masterplan which regulates how rainwater percolates, accumulates, and ultimately drains across the urban landscape (Gupta, 2007). The Municipal Corporation of Greater Mumbai's (MCGM) Storm Water Drains (SWD) Department is responsible for the implementation of both the physical infrastructure and the operational practices that comprise this masterplan, from construction and maintenance to flood management protocols. The stormwater drainage system based on the BRIMSTOWAD masterplan is an integrated network of engineered and natural drainage pathways. The network comprises of constructed open/closed concrete drains which are in many places (particularly in parts of Greater Mumbai) connected to natural drains (nallhas, rivers, streams and creeks) for the purpose of channelling, discharging and releasing rainwater into the sea (BMC, 2018). It includes creating concrete embankments along the nallahs to contain outflows, and pumping stations near the mouth of estuaries to manage tidal backflow during heavy rains.

Despite significant public investment, Mumbai's BRIMSTOWAD masterplan has proven ineffective in flood prevention due to two fundamental shortcomings. The first lies in its outdated hydraulic design which was initially engineered to account for two events per year of 50mm/hour rainfall intensity, was recommended to account for 100mm/hr rainfall post the 2005 flood (Chitale, 2006). It, however, was not modified in plan and eventually revised slightly to accommodate 65mm/hour in few selected zones only (BMC, 2018; Chitale, 2006). This revision remains grossly inadequate, as historical rainfall data from the IMD for 1999-2004 demonstrates that peak intensities exceeded 72mm/hour rainfall 80% of the time, while contemporary climate extremes regularly surpass 100mm/hour rainfall (Gupta, 2007; *IMD*). The second, more fundamental flaw stems from its narrowly technocratic approach that conceptualises stormwater solely as excess to be disposed off, while completely disregarding its complex socio-ecological relationships with the city's landscapes and people (Chitale, 2006). This reductive engineering paradigm has produced multiple cascading failures: the concrete channelisation of natural drains and construction of embankments have displaced vulnerable informal settlements while protecting formal developments (Parthasarathy, 2009), degraded critical mangrove ecosystems and disrupted tidal flows in ways that ironically exacerbate flooding in certain suburban areas (Indorewala & Wagh, 2018), and institutionalised spatial inequities through disproportionate allocation of pumping stations to high real-estate neighborhoods in the south at the expense of northern suburbs dependent on gravity-based drainage. These systemic issues reveal the project's deeper contradiction where its intensive infrastructure conflicts with pressing needs for affordable housing and ecological conservation, while its implementation reflects and reinforces Mumbai's unequal political economy (Stecko & Barber, 2007). MMRDA's (Mumbai Metropolitan Region Development Authority) development of the Bandra Kurla Complex by landfilling 600 acres of the Mithi river (which flooded in 2005) is exemplary in this

case (Lewis, 2019). The resulting planning practices have not only proven exploitative in their execution but have also transformed flooding from a natural phenomenon into a techno-politically 'engineered' disaster.

Case study: Malad Wall Collapse, 2019

Mumbai recorded two extreme rainfall events on 29th June 2019 and 2nd July 2019 with the Santacruz observatory of the Indian Meteorological Department in the suburban city region recorded 234.8mm and 375.2mm of rain respectively, along with heavy showers observed on the night of 1st July 2019 as well[4] (*IMD*; "Monsoon Covers Ground," 2019) . At about 11.45pm on the night of 1st July, the 2.3km long (about 4-6m of varying height) periphery wall of the MCGM's Malad Hill Reservoir facility in Malad, Mumbai breached and collapsed at two points, in the adjoining settlements of Ambedkar Nagar and Pimpripada, a few hundred meters apart causing terrible devastation and loss of human life (Malad Wall Collapse, 2019). The wall collapse completely destroyed 140-160 houses in Ambedkar Nagar[5] and 65 houses in Pimpripada while flooding and damaging 80-95 houses in both areas. It resulted killing 31 people and leaving around 130 injured from about 86 families (Barnagarwala, 2019; Malad Wall Collapse, 2019; Marpakwar, 2021; Press Trust of India, 2019).

Figure 3: Photos of the uncollapsed wall (LEFT) and of the collapsed portions (MIDDLE and RIGHT) (Malad Wall Collapse, 2019)

Figure 4: Satellite imagery showing transect of the site with encircled locations of wall collapse

4 As per observations from the IMD, the Malad area in Mumbai received as much as 183 mm of rainfall in a short span of 3 hours between 10 pm on 30th June and 1pm on 1st July (IMD; Malad Wall Collapse, 2019).

5 As per survey conducted by Centre for Promoting Democracy (CPD) and Pani Haq Samiti (PHS) in July 2019 post the wall collapse event.

Methodology

This case study builds upon the observations and findings of the independent fact-finding committee's 2019 interim report titled 'Malad Wall Collapse: A state induced disaster' (Malad Wall Collapse, 2019). In this study, I employ an integrated methodological approach to examine the Malad wall collapse and its ongoing socio-spatial consequences. Through extensive fieldwork conducted during January-February 2025, I systematically documented the reservoir site and surrounding settlements using a transect-based spatial analysis framework. This approach enabled a critical examination of both the physical landscape of destruction and the lived experiences of affected communities, tracing how the disaster continues to shape everyday life along its path of devastation. The study combines archival investigation of historical news reports and relevant court cases with qualitative data gathered through semi-structured interviews and participatory walks along the transect with different actors including BMC engineers, municipal reservoir workers, and members of affected families. These techniques were used to corroborate and expand upon the fact-finding report. The transect-based spatial methodology functions as a critical analytical framework, bridging this study's theoretical foundations with empirical observations to systematically trace the interconnected relations of stormwater infrastructure to practices of housing and environmental regulation on site.

Consequences of 'constructed' presence and 'planned' absence of stormwater infrastructure

MCGM's Malad Hill Reservoir facility[6] is situated on the western edge of the Sanjay Gandhi National Park (SGNP) in Mumbai, spread across 46 acres—of which roughly half falls under forest land reservation—on a hilly terrain that's around 70-80m above mean sea level, with its boundary guarded on all sides by the high wall (Malad Wall Collapse, 2019). The observations from the fact-finding committee's interim report highlight significant deficiencies in the stormwater infrastructure, reveal a drainage system that is grossly inadequate in both design and maintenance inside the facility and completely absent in the adjoining settlements that lie downhill. My spatial documentation of the facility corroborates these observations, documenting a fragmented network of discontinuous drains and concrete culverts that remain obstructed by accumulated debris and unchecked vegetation growth. The facility's municipal workers interviewed on-site confirmed the absence of repair and maintenance efforts for the critical drainage infrastructure. Considering the topography of the site coupled with inefficient stormwater infrastructure inside the facility (see Figure 5), the boundary wall becomes a major obstruction to the natural drainage paths of rainwater that run downhill.

6 The facility constitutes of two water reservoir tanks, control rooms and housing for MCGM staff. Tank 1, which was renovated in 2017, has a capacity of 11 Million Gallon. Tank 2 is a smaller tank with a capacity of 4 Million Gallon, but remains under-utilised since it hasn't been repaired and is leaking from beneath due to its deteriorating condition (Data based on spatial documentation interviews of the facility's municipal workers and engineers conducted during field visit).

Figure 5: Satellite imagery of the site showing the boundary wall of the facility in red, overlaid with GIS based contour show direction of water flow (indicated with arrows), and natural drainage pathways in blue (Malad Wall Collapse, 2019)

The technical investigation committee (TIC), comprising of engineers and experts, constituted by the State to probe the event stated in its report that heavy rainfall coupled with holes in the wall blocked by the hutment dwellers resulted in the mishap (Ozarkar & Sharma, 2019). However, a closer inspection of the entire periphery wall through my spatial mapping—which is concurring with the investigations of the fact finding report—reveals that the wall itself is in fact technically flawed in its design and structure. It was constructed without any consideration for stormwater runoff, containing very few weep holes placed in a randomised manner scattered across some selective sections only. Unlike retaining walls, this wall was not built to sustain lateral pressures resulting from soil and rainwater accumulation (Malad Wall Collapse, 2019; Singh, 2019). This critical infrastructure led the adjoining housing tenements to be *walled against* a significant volume of water that had accumulated due to the heavy downpour of that night and the previous day. It was indeed built as *an infrastructure of containment, not protection* to shut out of sight and contain the adjoining dwellers who are perceived as "encroachers" by the state and judiciary, than protect them from landslides and flooding (Malad Wall Collapse, 2019). Except for the collapsed portions, the wall still stands the same way with no modifications or alterations made for drainage whatsoever even five years post the disaster. The Maharashtra State Government has in February 2025 approved a plan to build a protective wall along the entire periphery of the Sanjay Gandhi National Park to keep it from "encroachers" (Deshmukh, 2025). The building of such separation walls has, thus, become a normative planning practice in Mumbai's planning: containing people from "nature" by precariously walling them against its unstoppable forces.

Housing precarity and environmental regulation in Ambedkar Nagar & Primpripada

The areas of Ambedkar Nagar and Pimpripada abutting the boundary wall, lie downhill from the reservoir facility on a slope that's around 30-60m, and are a part of a much larger settlement that falls under the forest land of the Sanjay Gandhi National Park. As per environmental regulations, parts of the settlement that lie within the delimited extents of the forest land are not allowed to use permanent building materials to construct their tenements (Agarwal, 2002). Thus, the tenements closer to the wall have resorted to practices of constructing stone plinths out of loose random rubble and using skeletal bamboo frames covered with materials such as plastic/tarpauline sheets for their superstructure (see Figure 6 and Figure 7). These temporally fragile structures proved catastrophically inadequate when confronted with the force of the wall's collapse, which sent flood water and massive boulders cascading downhill.

The settlements have been denied and devoid of any formal infrastructure for managing stormwater drainage and depend almost entirely on ground water (sourced from an open well located downhill) for their domestic purposes. Following writ petitions and orders from the Bombay High Court in 1997, people living in this settlement—which is predominantly constituted by socio-economically marginalised groups of Dalits and

Muslims—were ought to be rehabilitated by the state government before evicting them from the forest land (Nivarra Hakk, 2000). Their rehabilitation has been pending ever since. However, the MCGM and forest department, in contempt of the court order, conducted forceful and violent demolitions in the settlement in 1999 and 2000 (Nivarra Hakk, 2000). Had the settlement residents been properly rehabilitated in compliance with court orders, their lives would not have been endangered on such hazardous terrain when the wall collapse in 2019. The resulting devastation was therefore not simply the consequence of rainfall-induced structural failure, but rather the direct outcome of deeply entrenched housing inequities and spatial injustice inflicted upon the urban poor belonging to marginalised communities who are forced to inhabit vulnerable and precarious conditions within the city.

Fig 6. Tenements on site (Photo by author)

Fig 7. Tenement on site and the periphery wall uphill in the background (Photo by author)

Stormwater drainage at the intersection of flooding, housing, and environmental deregulation

The case of the Malad wall collapse event indicates a much deeper urban crisis that weaves together issues of stormwater drainage, housing, exclusionary forms of material infrastructures, and environmental conservation. The wall collapse event brought to the surface the overlapping epistemic injustices, connecting questions of drainage to housing precarity and environmental regulation which otherwise lay dormant yet very much present in the everyday lives of the Ambedkar Nagar and Pimpripada residents. The wall (and its partial collapse in time) symbolises, both materially and ideologically, the exclusive nature of environmental regulations aimed at conservation where the urban poor are singled out as "encroachers" on contested eco-sensitive lands, the SGNP in this case. While land disputes and the notion of 'encroachment' surrounding SGNP have been widely analysed within environmental debates (Bhide, 2009; Parthasarathy, 2011; Sen & Pattanaik, 2015), this paper employs the case of the 2019 wall collapse to illuminate one of the many critical dimensions of SGNP's complex environmental conflicts. The incident reveals the fundamental tension inherent in SGNP's dual identity as both a protected forest land and a transient (albeit at times violent) waterscape that amplifies risks for marginalised communities inhabiting its lands, peripheries, and fringes. State planning mandates protective measures such as boundary wall construction to safeguard forest lands, reinforced by environmental regulations that impose restrictions on building practices of the informal albeit legal settlements within these areas. However, the park's hydrological system, comprising of rivers, runoff channels, and hillslopes, functions as an active catchment zone (Mapping Aarey, 2019) by disproportionately endangering precariously housed residents abiding by the state's planning mandates. The fundamental paradox of this condition lies in the state's imposition of "forest land" zoning which does not consider the temporal nature of water that flows within this land. While the planning forcibly restricts residents to precarious, makeshift housing constructed with temporary materials, it simultaneously authorises the state to erect permanent concrete structures—which often fail to meet basic structural and environmental standards, as demonstrated by the Malad case—such as boundary walls, tunnels for highways, concretised link-roads, and metro sheds on the very same terrain as projects for economic development, often overlooking the implications of these on the forest's social-hydrology (Mapping Aarey, 2019; MMRDA, 2015; Sen & Nagendra, 2019; Surve, 2023). This contradiction reveals how conservation zoning operates as a material practice of spatial injustice. It criminalises legal informal settlements as "encroachments" while legitimising state infrastructure that exacerbates flood risks (in this case, boundary walls that obstruct natural drainage and intensify flood vulnerability). By framing the land as inviolable forest land yet buildable for state

projects, the policy perpetuates a double standard that perpetuates urban marginalisation under the guise of technical necessities for environmental protection.

The persistent question for housing, prior to and post the Malad wall collapse, exposes the systemic injustices at the heart of Mumbai's housing crisis. This case compels us to treat housing and spatial justice as non-negotiable parameters in stormwater infrastructure planning, especially in flood prone areas. The actions of residents in Ambedkar Nagar and Pimpripada, of building and occupying precarious homes since 1997, must be recognised as everyday practices by those most marginalised of coping with state planning practices that endanger their living environments. The exclusion of informal settlements from municipal stormwater drainage networks, the inadequate construction and maintenance of stormwater infrastructure, and the collapse of infrastructures during extreme rainfall events must be understood not as planning failures or oversights, but as intrinsic outcomes of Mumbai's technocratic planning paradigm (Indorewala, 2018). This system is principally rooted in valuing land solely for its economic potential and, thus, through its practices, systematically undermines its vital socio-ecological relationships with water systems and communities, inevitably producing disastrous environmental consequences for the city.

Conclusion

The inferences drawn from the ineffectiveness of the BRIMSTOWAD masterplan to prevent flooding combined with an analysis of the Malad wall collapse, demonstrates that Mumbai's chronic flooding problem is not a planning failure but rather the inevitable consequence of a technocratic planning system that subordinates socio-ecological considerations of water to the economic development of its land. The BRIMSTOWAD infrastructure as a techno-fix, designed to withstand only 50–65 mm/hr rainfall despite evidence of intensifying monsoons, reveals a deliberate disregard for both hydrological science and environmental justice. The stormwater drainage system's challenges and inadequacies—whether in excluding informal settlements, degrading natural drainage channels, or dysfunctions under climate extremes—are not technical miscalculations but logical outcomes of a planning paradigm that treats land as a commodity and all stormwater as disposable excess. The 2019 Malad wall collapse event, which killed 31 residents of an informal albeit legal settlement, exposes how issues of stormwater drainage are linked to inter-connected urban crises concerning housing and environmental regulation, thereby furthering the marginalisation of vulnerable communities. Such marginalisation and spatial vulnerability is not accidental but engineered. It is a direct result of planning that uses material practices of environmental regulation to displace and dispossess the urban poor. The boundary wall of the Malad facility shares both ideological and aesthetic similarities with the embankment walls of the BRIMSTOWAD project. Both structures serve a containment function. The BRIMSTOWAD's walls are designed to control and contain stormwater, while the Malad reservoir's periphery wall effectively confines adjacent informal settlements. Though their stated purposes differ, stormwater remains the common thread. It is the explicit target in BRIMSTOWAD's engineering, but implicitly present in the periphery infrastructure shaping the vulnerability of communities living near the reservoir facility.

The lived experiences and practices of those navigating waterlogged homes, inundated streets, and collapsing infrastructure reveal what official plans obscure, that flood risk is not natural but engineered. This paper has attempted to problematise flooding and related urban crises through the material practices that shape planning and the everyday in Mumbai. Reflecting on these practices would help us to understand—as Lefebvre puts it—'how people live or how badly they live, or how they do not live at all' (Lefebvre, 2014). The task ahead is not to "fix" flooding but to dismantle the systems that produce it.

Reference

Agarwal, S. (2002). *Environment Management Plan For Sanjay Gandhi National Park, Borivali* [Final Report]. MMR-Environment Improvement Society, Govt. of Maharashtra.

Anand, N. (2017). *Hydraulic city: Water and the infrastructures of citizenship in Mumbai*. Duke University press.

Barnagarwala, T. (2019, July 21). Malad wall collapse: 50-year-old woman dies, toll climbs to 31. *The Indian Express*. https://indianexpress.com/article/cities/mumbai/malad-wall-collapse-50-year-old-woman-dies-toll-climbs-to-31-5839740/

Baviskar, A. (2017). What the Eye Does Not See: The Yamuna in the Imagination of Delhi. In S. Hall & R. Burdett, *The SAGE*

Handbook of the 21st Century City (pp. 298–313). SAGE Publications Ltd. https://doi.org/10.4135/9781526402059.n16

Bhide, A. (2009). Shifting terrains of communities and community organization: Reflections on organizing for housing rights in Mumbai. *Community Development Journal*, *44*(3), 367–381. https://doi.org/10.1093/cdj/bsp026

Björkman, L. (2015). *Pipe politics, contested waters: Embedded infrastructures of millennial Mumbai*. Duke University Press.

BMC. (2018). *BRIMSTOWAD-II Master Plan—City*. Brihanmumbai Municipal Corporation.

Boelens, R., Hoogesteger, J., Swyngedouw, E., Vos, J., & Wester, P. (2016). Hydrosocial territories: A political ecology perspective. *Water International*, *41*(1), 1–14. https://doi.org/10.1080/02508060.2016.1134898

Bryant, R. L. (1998). Power, knowledge and political ecology in the third world: A review. *Progress in Physical Geography*, *22*(1), 79–94.

Chitale, M. (2006). *Fact Finding Committee on Mumbai Floods: Volume I*. Brihanmumbai Municipal Corporation.

Davidoff, P. (1965). ADVOCACY AND PLURALISM IN PLANNING. *Journal of the American Institute of Planners*, *31*(4), 331–338. https://doi.org/10.1080/01944366508978187

Deshmukh, R. (2025, February 25). Maharashtra Govt Plans Δ196 Crore Protective Wall Around Sanjay Gandhi National Park After Facing Flak Over Encroachments & Prolonged Issue Of Rehabilitation. *The Free Press Journal*. https://www.freepressjournal.in/mumbai/maharashtra-govt-plans-196-crore-protective-wall-around-sanjay-gandhi-national-park-after-facing-flak-over-encroachments-prolonged-issue-of-rehabilitation

Dossal, M. (1996). *Imperial designs and Indian realities: The planning of Bombay City, 1845 - 1875*. Oxford University Press.

Fainstein, S. S. (2010). *The just city*. Cornell university press.

Forester, J. (1980). Critical Theory and Planning Practice. *Journal of the American Planning Association*, *46*(3), 275–286. https://doi.org/10.1080/01944368008977043

Furlong, C., De Silva, S., Guthrie, L., & Considine, R. (2016). Developing a water infrastructure planning framework for the complex modern planning environment. *Utilities Policy*, *38*, 1–10. https://doi.org/10.1016/j.jup.2015.11.002
Gandy, M. (2014). Water, Poverty, and Urban Fragmentation in Mumbai. In *The fabric of space: Water, modernity, and the urban imagination* (pp. 109–144). MIT Press.

Goh, K. (2019). Urban Waterscapes: The HydroΔPolitics of Flooding in a Sinking City. *International Journal of Urban and Regional Research*, *43*(2), 250–272. https://doi.org/10.1111/1468-2427.12756

Gupta, K. (2007). Urban flood resilience planning and management and lessons for the future: A case study of Mumbai, India. *Urban Water Journal*, *4*(3), 183–194. https://doi.org/10.1080/15730620701464141

Harvey, D. (2009). *Social justice and the city* (Rev. ed). University of Georgia Press.

Henrique, K. (2023). Repositioning marginal spaces in climate adaptation. In M. Armiero, E. Turhan, & S. P. De Rosa, *Urban Movements and Climate Change*. Amsterdam University Press. https://doi.org/10.5117/9789463726665_ch08
Indian Metereological Department. (n.d.). [Informational]. India Meteorological Department Ministry Of Earth Sciences Government Of India. Retrieved April 22, 2025, from https://mausam.imd.gov.in

Indorewala, H. (2018). *Case Study—Resettling the city: Discriminatory planning and environmental deregulation in Mumbai* (Building Inclusive Urban Communities (BINUCOM), p. 29) [Case Study]. Kamla Raheja Vidyanidhi Institute of Architecture and Environmental Studies. https://mdl.donau-uni.ac.at/binucom/pluginfile.php/405/mod_page/content/38/KRVIA_5_K.pdf

Indorewala, H., & Wagh, S. (2018, July 20). Here's Why Mumbai Floods Year After Year. *The Wire Science*. https://science.thewire.in/society/urban/mumbai-heavy-rains-floods-reasons/

Indorewala, H., & Wagh, S. (2022). Metropolitan Nature: Environment and Planning in Mumbai. In L. Pattaroni, A. Bhide, & C. Lutringer (Eds.), *Politics of Urban Planning: The Making and Unmaking of the Mumbai Development Plan 2014–2034* (pp. 159–174). Springer Singapore. https://doi.org/10.1007/978-981-16-8671-9

Indorewala, H., Wagh, S., Ramakrishnan, U., & Nandlaskar, O. (2016). *City profile Mumbai* (Report Prepared in the BINUCOM (Building Inclusive Urban Communities) Project, Funded by the Erasmus+ Program of the European Union.). KRVIA - KRVIA - Kamla Raheja Vidyanidhi Institute of Architecture and Environmental Studies. http://moodle.donau-uni.ac.at/binucom/

Jamwal, N. (2017). That Sinking Feeling. *Mumbai Reader*, 85–99.

Kaika, M. (2005). *City of flows: Modernity, nature, and the city*. Routledge.

Karpouzoglou, T., & Vij, S. (2017). Waterscape: A perspective for understanding the contested geography of water. *WIREs Water*, *4*(3), e1210. https://doi.org/10.1002/wat2.1210

Lefebvre, H. (2014). *Critique of Everyday Life: The one-volume edition* (One-vol. ed). Verso. https://umranica.wikido.xyz/repo/9/95/Critique_of_Everyday_Life_-_Henri_Lefebvre.pdf

Lewis, C. (2019, September 8). Mithi floods due to 600 acres reclaimed for BKC, SC told. *Times of India*. https://timesofindia.indiatimes.com/city/mumbai/mithi-floods-due-to-600-acres-reclaimed-for-bkc-sc-told/articleshow/71031129.cms

Liao, Y.-K., & Schmidt, J. J. (2023). Hydrosocial geographies: Cycles, spaces and spheres of concern. *Progress in Environmental Geography*, *2*(4), 240–265. https://doi.org/10.1177/27539687231201667

Linton, J., & Budds, J. (2014). The hydrosocial cycle: Defining and mobilizing a relational-dialectical approach to water. *Geoforum*, 57, 170–180. https://doi.org/10.1016/j.geoforum.2013.10.008

Malad Wall Collapse: A State Induced Disaster (p. 20). (2019). [Fact finding report].

Mapping Aarey: A Study of the Impacts of Land Use / Land Cover Changes on Catchment Areas and Ecosystems (p. 55). (2019). Kamla Raheja Research and Design Cell, Kamla Raheja Vidyanidhi Institute of Architecture and Environmental Studies. https://krviadesigncell.wordpress.com/2019/12/01/mapping-aarey-a-study-of-the-impacts-of-land-use-land-cover-changes-on-catchment-areas-and-ecosystems/

Marcuse, P., Connolly, J., Novy, J., Olivo, I., Potter, C., & Steil, J. (Eds.). (2009). *Searching for the just city: Debates in urban theory and practice*. Routledge.

Marpakwar, C. (2021, September 21). Mumbai: 2 years later, 70 families hit by Malad wall crash yet to be rehabilitated. *The Times of India*. https://timesofindia.indiatimes.com/city/mumbai/mumbai-2-yrs-later-70-families-hit-by-malad-wall-crash-yet-to-be-rehabilitated/articleshow/86152965.cms

Mathur, A., & Cunha, D. da. (2009). *Soak: Mumbai in an estuary*. Rupa & Co.

Meera Kosambi, M. (1986). *Bombay in Transition: The Growth and Social Ecology of a Colonial City, 1880-1980*. Almqvist & Wiksell International.

Menon, M., Kapoor, M., Venkatram, P., Kohli, K., & Kaur, S. (2015). *CZMAs AND Coastal Environments: Two decades of regulating land use change on India's coastline* (Namati Environmental Justice Program, p. 188). Centre for Policy Research; Namati.

MMRDA. (2015). *Twin Tube Tunnel between Thane and Borivali* [Informational]. Mumbai Metropolitan Region Development Authority. https://mmrda.maharashtra.gov.in/projects/infrastructure/milan-rail-over-bridge/overview

Monsoon covers ground: Mumbai gets 97% of June rain in two days. (2019, June 30). *The Times of India*. https://timesofindia.indiatimes.com/city/mumbai/monsoon-covers-ground-mumbai-gets-97-of-june-rain-in-two-days/articleshow/70006959.cms

Nijman, J. (2002). The Effects of Economic Globalization: Land Use and Land Values in Mumbai, India. In R. Grant & J. R. Short (Eds.), *Globalization and the Margins* (pp. 150–169). Palgrave Macmillan UK. https://doi.org/10.1057/9781403918482_10

Nivarra Hakk. (2000). *Crushed homes, lost lives: The story of the demolitions in the Sanjay Gandhi National Park*. Indian Peoples Human Rights Tribunal on SGNP Demolitions. https://www.nivarahakk.com/publications/crushed%20homes%20Lost%20lives.pdf

Ozarkar, & Sharma, S. (2019, December 27). 'No one to blame' for Malad wall collapse. *Mumbai Mirror*. https://mumbaimirror.indiatimes.com/mumbai/civic/no-one-to-blame-for-malad-wall-collapse/articleshow/72987436.cms

Parthasarathy, D. (2009). Social and environmental insecurities in Mumbai: Towards a sociological perspective on vulnerability. *South African Review of Sociology*, *40*(1), 109–126. https://doi.org/10.1080/21528586.2009.10425103

Parthasarathy, D. (2011). Hunters, Gatherers and Foragers in a Metropolis: Commonising the Private and Public in Mumbai. *Economic and Political Weekly*, *50*.

Press Trust of India. (2019, July 20). News_31 Killed In Mumbai's Malad Wall Collapse Mumbai.pdf. *NDTV*. https://www.ndtv.com/mumbai-news/31-killed-in-mumbais-malad-wall-collapse-mumbai-2072715

Ranganathan, M. (2015). Storm Drains as Assemblages: The Political Ecology of Flood Risk in Post-Colonial Bangalore: Stormwater Drains as Assemblages. *Antipode*, *47*(5), 1300–1320. https://doi.org/10.1111/anti.12149

Rao, N. (2013). *House, but no garden: Apartment living in Bombay's suburbs, 1898 - 1964*. Univ. of Minnesota Press.

Rusca, M., & Cleaver, F. (2022). Unpacking everyday urbanism: Practices and the making of (un)even urban waterscapes. *WIREs Water*, *9*(2), e1581. https://doi.org/10.1002/wat2.1581

Sen, A., & Nagendra, H. (2019). Mumbai's Blinkered Vision of Development. *Economic and Political Weekly*, *9*.

Sen, A., & Pattanaik, S. (2015). Alienation, Conflict, and Conservation in the Protected Areas of Urban Metropolis: A Case Study of Sanjay Gandhi National Park, Mumbai. *Sociological Bulletin*, *64*(3), 375–395. https://doi.org/10.1177/0038022920150306

Singh, V. (2019, June 5). BMC had spent Rs 21 crore on Malad wall that collapsed in two years. *Times of India*. https://timesofindia.indiatimes.com/city/mumbai/bmc-had-spent-rs-21cr-on-malad-wall-that-collapsed-in-2-yrs/articleshow/70079628.cms

Stecko, S., & Barber, N. (2007). Exposing Vulnerabilities: Monsoon Floods in Mumbai, India. *Revisiting Urban Planning*. Global Report on Human Settlements 2007.

Surve, S. (2023, November 14). Mumbai: To decongest WEH, BMC plans to link Kurar, Malad reservoir. *Mid-Day*. https://www.mid-day.com/mumbai/mumbai-news/article/to-decongest-weh-bmc-plans-to-link-kurar-malad-reservoir-23319757

Swyngedouw, E. (1999). Modernity and Hybridity: Nature, Regeneracionismo, and the Production of the Spanish Waterscape, 1890-1930. *Taylor & Francis, Ltd. on Behalf of the Association of American Geographers*, *89*(3), 443–465. https://doi.org/10.1111/0004-5608.00157

Swyngedouw, E., Kaika, M., & Castro, E. (2002). Urban Water: A Political-Ecology Perspective. *Built Environment (1978-)*, *28*(2), 124–137. https://www.jstor.org/stable/23288796

Wagh, S. (2018). Resources, Livelihoods and Spatial Control: Urban Nature and Practices of Commoning in the Neoliberal City. In Dr. P. Datta & N. Gupta (Eds.), *Urban Spaces in India* (pp. 29–52). Indian Institute of Advanced Study.

Wagh, S., & Indorewala, H. (2025). A Road to Coastal Deregulation. *Economic and Political Weekly*, *2*.

Zope, P. E., Eldho, T. I., & Jothiprakash, V. (2015). Impacts of urbanization on flooding of a coastal urban catchment: A case study of Mumbai City, India. *Natural Hazards*, *75*(1), 887–908. https://doi.org/10.1007/s11069-014-1356-4